

**EPA Superfund
Record of Decision:**

**JFD ELECTRONICS/CHANNEL MASTER
EPA ID: NCD122263825
OU 01
OXFORD, NC
09/10/1992**

Text:

EPA Superfund Record of Decision:

JFD Electronics Channel

Master, NC

NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

JFD ELECTRONICS/CHANNEL MASTER SITE

OXFORD, GRANVILLE COUNTY

NORTH CAROLINA

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA. GEORGIA

DECLARATION

FOR

THE RECORD OF DECISION

SITE NAME AND LOCATION

JFD Electronics/Channel Master

Oxford, Granville County, North Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the JFD Electronics/Channel Master Superfund Site (the "Site") in Granville County, North Carolina, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record file for this Site.

The State of North Carolina conditionally concurs with the selected remedy. State comments on the ROD, as well as EPA's responses to those comments, can be found in Appendix A of this document.

DESCRIPTION OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of

Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This remedial action addresses the soil, sludge, and groundwater contamination at the Site. The major threat is the contaminated groundwater migrating off-site.

The major components of the selected remedy include:

GROUNDWATER

Extraction of groundwater from the Site in the overburden/fractured bedrock aquifer that is contaminated above Maximum Contaminant Levels or the North Carolina Groundwater Standards;

On-site treatment of extracted groundwater via alkalinechlorination, precipitation/filtration, air stripping, and carbon adsorption to reduce contaminants to either MCLs or State Standards, whichever are most protective;

Discharge of treated groundwater to the local Publicly Owned Treatment Works (POTW) or a nearby surface water pathway. The discharge location will be determined in the Remedial Design phase; and

Continued monitoring for contaminants in groundwater.

SLUDGE/SOIL

Excavation of on-site contaminated sludge and soil;

On-site treatment of contaminated sludge and soil using reductionoxidation and stabilization until the LDRs or treatability variance treatment levels established for the metals of concern have been met;

On-site disposal, or backfilling, of the treated sludge/soil into the excavated area;

Placing a cap over the treated sludge and soil to:

1) minimize the potential for adverse health risks due to direct contact with residual contamination; 2) impede the infiltration of any residual contamination into the groundwater aquifer; and 3) minimize the possibility for surface water runoff from the area of contamination.

ADDITIONAL SAMPLING AND MONITORING

The installation of additional monitoring wells will be required during the RD to further characterize the nature and extent of groundwater contamination.

In order to establish a broader data base on groundwater quality, additional groundwater samples will be collected and analyzed for TCL/TAL constituents. In order to maintain a level of protection for the residential well owners

living immediately downgradient from the Site, samples will be collected and analyzed every four months prior to implementation of the remedial action.

Additional surface water and sediment samples shall be collected and analyzed during the RD from the surface water pathways located adjacent to and downgradient of the Site to confirm and verify that these pathways are not being adversely impacted by the Site.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The Land Disposal Restrictions (LDRs) are applicable or relevant and appropriate for the treatment of the sludge and soil at this Site because the sludge is a RCRA listed hazardous waste. A Treatability Variance will be used to comply with the LDRs. This remedy utilizes permanent solutions and alternative treatment technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Since this remedy may result in hazardous substances remaining on-site above health based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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Reduction of Toxicity, Mobility, or Volume
Short-term Effectiveness
Implementability
Cost
State Acceptance
Community Acceptance

B. SLUDGE/SOIL REMEDIATION

Overall Protection
Compliance with ARARs

Long-term Effectiveness and Permanence
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DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

A. Introduction

The JFD Electronics/Channel Master Site (the Site) is located at 620 West Industry Drive, Oxford, Granville County, North Carolina. The Site is located approximately 2 miles southwest of Oxford. From 1961-1979, JFD Electronics owned and operated various manufacturing processes primarily associated with the production of television antennas. From 1980 through 1984, Channel Master owned the property and assembled satellite systems at the Site. All manufacturing/assembly operations at the Site ceased in 1984; Channel Master moved its operations to their Smithfield, North Carolina facility.

B. Site Description

The Site is located on a 13.09-acre parcel of property. The property is bordered to the north by Pine Tree Road, to the west by Industry Drive, to the south by a railroad line owned by Southern Railroad, and to the east by a residential development. Refer to Figure 1.

The main building at the Site is currently being utilized by Hamilton/Avnet Electronics as a warehouse distribution center. A smaller building located on-site is currently being used by the Bandag Corporation as a distribution warehouse.

C. Topography

The Site is situated in the Piedmont physiographic province in north-central North Carolina. The Piedmont physiographic province surrounding the Site is characterized by a broad, relatively level highland, with ground surface elevations on-site ranging from 448 to 478 feet above mean sea level.

D. Geology/Hydrogeology

The Site lies within the geologic belt known as the Carolina Slate Belt. The Carolina Slate Belt generally consists of crystalline basement rocks of unknown age overlain by a volcanogenic sequence of late Precambrian to early Paleozoic age. Most of these rocks near the surface have weathered into a layer of "overburden", generally ranging in thickness from 55 to 60 feet at the Site. This layer consists of weathered bedrock, saprolite, residual soils, and to a lesser extent, alluvium.

Groundwater at the Site occurs in an unconfined-to-semiconfined aquifer consisting of overburden hydraulically interconnected with underlying bedrock. Approximate depth to groundwater generally ranges from 7 to 11 feet below land surface. The saturated thickness in the overburden portion of the aquifer is 40 to 50 feet. During the wetter periods of the year, groundwater may intersect the ground surface at specific locations of the drainage ditch located along the southern border of the Site.

Site soils are classified as Appling loamy sands and Appling-Urban land complex. Appling loam soils are characterized as well-drained soils on nearly level to strongly sloping piedmont uplands (e.g., sandy loam, clay. clay loam, sandy clays). Urban land complex soils at the Site are the result of both construction and former cleanup activities undertaken by the owners/operators of the facility.

E. Surface Water

Surface water drainage and flow patterns on the Site are generally controlled by grading and several man-made drainage ditches. Runoff and drainage from the main building, the parking areas south of the main building, and the former lagoon and treatment tank area, generally flow southward and are collected by the drainage ditch flowing along the southern border of the property. Runoff and drainage on the eastern portion of the Site generally flow into a drainage ditch that borders the eastern edge of the Site. The two drainage ditches converge near the southeastern corner of the Site and flow southward approximately 1.75 miles to Fishing Creek.

Potentiometric data indicates that groundwater generally flows to the southeast from the Site, then turns eastward in the vicinity of the Southern Railroad right-of-way. This flow pattern is consistent with the topographic slope and the direction of intermittent stream flow in the area.

F. Meteorology

Granville County has a relatively moderate climate, with mild winters and hot, humid summers. Seasonal temperatures average between 42 and 44 in January to 78 and 80 in July. Yearly rainfall across this portion of the Piedmont averages between 44 to 48 inches.

The average wind speed throughout the Piedmont is 9 miles per hour. Winds generally blow from a south/southwesterly direction.

G. Demography and Land Use

The Site is located in an industrial park. Land use to the Site's immediate west, northwest, and southwest is primarily industrial/light manufacturing and storage. Residential areas are located east and southeast of the Site. The average population density in Granville County, North Carolina, according to preliminary 1990 census data, is 72.2 persons per square mile. This density increases to 164 persons per square mile in the city of Oxford.

The downtown area of Oxford lies approximately 2 miles northeast of the Site. The projected population of the city by 1995 is estimated to be

42,425.

H. Utilities

Electricity, telephone, natural gas, and city water are available at the Site. Granville County sewage connection is available at the Site.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site History

From 1961 to 1979, JFD Electronics (a subsidiary of Unimax Corporation) manufactured television antennas at the Site. An unlined lagoon was built from 1964 to 1965 to dispose of wastewater generated from a chromate conversion process and a copper/nickel electroplating process. The lagoon reportedly held from 800,000 to 1,000,000 gallons of sludge during its operation. In October 1979, Channel Master Satellite Systems, Inc. (a subsidiary of Avnet Inc.) began leasing the Site. Channel Master bought the Site in 1980 and used it to produce satellite systems from 1980 to 1984. Indoor and outdoor antennas, amplifiers, and boosters were also assembled on-site during this time period. Organic solvents were reportedly used on-site for cleaning tools and the antenna elements prior to sending them off-site for electroplating.

Reported sources of contamination at the Site included the sludge lagoon and eleven sludge drying beds, an unconfirmed number of underground storage tanks, soils contaminated with volatile organic compounds (VOCs) associated with a leaking waste oil tank, and several other areas associated with disposal practices of cleaning solvents. Refer to Figure 2.

The North Carolina Department of Human Resources - CERCLA unit (NCDHR-CERCLA) (now called the North Carolina Department of Environment, Health, and Natural Resources or NCDEHNR) conducted a site inspection on February 23, 1987. Analyses of the lagoon sludge and adjacent soils revealed the presence of chromium, lead, arsenic, cyanide, and VOCs. Sampling of the groundwater revealed the presence of dichloroethane, trichloroethene, tetrachloroethene, and xylene.

Channel Master initiated cleanup activities at the Site in June 1987 under the supervision of the NCDHR-CERCLA unit. These activities included excavating approximately 17,000 cubic yards of contaminated sludge/soil and disposing of it in a permitted waste disposal facility. Approximately 2,000 cubic yards of VOC-contaminated soil were also excavated and thermally treated to destroy the VOCs. In July 1988, Channel Master excavated and disposed of two fuel oil tanks and one concrete waste oil tank.

Site visits were conducted by representatives of the Agency for Toxic Substances and Disease Registry (ATSDR) in March 1989 and later by EPA in September 1989. Based on these inspections and on information collected since 1988, both EPA and ATSDR concluded that contamination still existed at the Site which warranted further investigation. Site contamination included soils contaminated with VOCs, groundwater contaminated with VOCs, and metal-contaminated sludge/soil associated with the sludge drying beds.

B. Enforcement Activities

The JFD Electronics/Channel Master Superfund Site was proposed for the National Priorities List (NPL) in June 1988 and was finalized on the list in October 1989.

On April 25, 1989, EPA sent special notice letters to:

1. Unimax Corporation (JFD's parent corporation)
2. Channel Master
3. Granville Industrial Developers

The letters requested that these potentially responsible parties (PRPs) conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Site. The notice letters also informed the PRPs of their liability for past costs. The PRPs declined to perform the RI/FS. On November 8, 1989, EPA sent a letter to the PRPs informing them of EPA's decision to conduct a fund-lead RI/FS at the Site.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Pursuant to Section 113(K)(2)(B)(i-v) and 117 of CERCLA, the Community Relations Plan and the RI/FS Reports were released to the public. The Proposed Plan for the Site was released to the public for comment on April 9, 1992. These documents were made available to the public in the Administrative Record located in both the Information Repository maintained at the EPA Docket Room in Region IV and at the Richard H. Thorton Public Library in Oxford, North Carolina. The notice of availability of these documents was published in the Oxford Ledger and the Durham Herald Sun newspapers on April 9, 1992. A public comment period was held from April 9, 1992 to May 8, 1992. A request for an extension of the public comment period was made. In addition, a public meeting was held on April 16, 1992. At this meeting, representatives from EPA answered questions about problems at the Site and the remedial alternatives under consideration. EPA extended the public comment period until June 8, 1992.

Other community relations activities included issuance of a fact sheet on the RI/FS process as well as a public meeting on the RI/FS in January 1990. EPA also issued a fact sheet to the public on the results of the RI in February 1992 and a Proposed Plan fact sheet in March 1992.

IV. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

The purpose of the remedial action presented in this ROD is to reduce future risks at this Site. This remedial action will remove the threat posed by contaminated groundwater and sludge/soil at the Site. Remediating the groundwater will prevent further migration of contaminants from the Site, as well as restoring the groundwater to its beneficial use. The remedial action for the sludge/soil will prevent the contaminants from adversely impacting the groundwater and will decrease the direct contact threat associated with Site sludge/soils. The remedial action will also reduce the possibility of Site contaminants adversely impacting surface water and sediment resulting from groundwater discharge or surface water runoff.

V. SUMMARY OF SITE CHARACTERISTICS

The purpose of the RI at the Site was to characterize the nature and extent of groundwater, sludge/soil, and surface water/sediment contamination.

A. Groundwater Investigation

The groundwater investigation was conducted in two phases; phase I was conducted in January-February 1991 and phase II was conducted in September-November 1991. Refer to Figure 3 for groundwater sample locations. In the first phase, a hydrocone sampling device was utilized to collect 34 samples from 19 locations on-site. Samples were collected at depths ranging from 15 to 24 feet below land surface. The hydrocone sampling instrument was used both as a field screening device to qualify the existence of the volatile organic compounds (VOCs) at the Site, and a means of determining where to locate the permanent monitoring wells during phase I.

Thirty-four hydrocone samples were analyzed on-site with a HNU Model 311 Gas Chromatograph (GC); GC analyses were for the three VOCs trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and tetrachloroethylene (PCE) since these VOCs had been identified in the groundwater during previous studies. The results of the GC analyses indicated that VOCs were present in the groundwater from the parking lot south of the main building, to the former lagoon area, and migrating off-site to the southeast. Total concentrations of TCE, 1,2-DCE, and PCE, as measured by the GC, ranged from 98,000 micrograms per liter (ug/l) in the parking lot area south of the main building (HC01) to 31,000 ug/l at the facility boundary near the former lagoon location (HC02). Other hydrocone sample locations (background and those in the eastern half of the Site) indicated lower total VOC concentrations.

Based on the GC results, certain hydrocone samples described in the previous paragraph were selected to be analyzed through EPA's Contract Laboratory Program (CLP) in order to quantify the extent of contamination. The analytical parameters for those samples included field parameters (pH, temperature, specific conductance), Target Compound List (TCL) volatiles, semivolatiles, and pesticides, as well as Target Analyte List (TAL) metals. Total concentrations of TCE, 1,2-DCE, and PCE in four of the hydrocone samples from the parking lot area south of the main building ranged from 364,410 ug/l to 697 ug/l. The remaining three samples (background and those in the eastern half of the Site) indicated lower VOC concentrations. Table 1 shows analytical results from six on-site hydrocone locations.

The last two numbers in the sample designation refer to the depth at which the sample was collected. Based on the results of the hydrocone sampling, five permanent monitoring wells were installed on-site (CMMW01-CMMW05) during phase I. Four of the wells were completed at depths ranging from 45 to 55 feet below land surface, including the upgradient well, and the fifth well was completed at 35 feet. During phase I, samples were collected from each of the five monitoring wells on-site as well as from three off-site residential wells. Refer to Figure 3 for the phase I and II groundwater sample locations on or adjacent to the Site. The residential well samples were collected along Highway 15 approximately quarter of a mile east of the Site. Total concentrations of TCE, 1,2-DCE, and PCE in four of the wells

ranged from 6,550 ug/l to 925 ug/l. The upgradient well, CMMW01, did not contain any VOCs. The metals chromium, copper, and nickel were also detected in the monitoring wells at concentrations ranging from 120-33 ug/l, 220-33 ug/l, and 91-29 ug/l, respectively. Refer to Table 2.

Sample analyses from the three residential wells (CMPW01, Finch well; CMPW02, Hightower well; and CMPW03, Knott well) did not indicate any TCL VOCs or SVOCs/pesticides during phase I. All of the wells (sampled at the tap) revealed elevated levels of copper, most likely due to the copper pipes used for the delivery system. Cyanide was detected in CMPW01 at 6.6 ug/l. No other Site-related metals were detected in any of the wells. Refer to Table 3.

Based on the results of the first phase of groundwater sampling performed in January-February 1991, EPA conducted a second phase of groundwater sampling in September-November 1991. A total of thirty temporary wells were installed in the shallow portion of the aquifer. Three of the temporary wells were installed on-site and twenty-seven were installed at locations south of the railroad tracks. Refer to Figure 3 for these locations. Six samples (CMTW01, CMTW02, CMTW03, CMTW08, CMTW24, AND CMTWBH17, 20-ft depth) were analyzed through the CLP for confirmation of the field screening data. Refer to Table 4.

In addition to the temporary wells, three permanent monitoring wells were installed at locations south of the railroad tracks in the intermediate-deep portion of the aquifer (depths ranging from 56 to 78 feet below land surface). Four residential wells were also sampled during phase 2.

GC analyses from the temporary wells indicated total VOC concentrations of TCE, 1,2-DCE, and PCE generally decreased as distance increased away from the parking lot south of the main building. One on-site well (CMTW01) indicated 281,100 ug/l VOCs while off-site VOC concentrations ranged from 1,630 ug/l to none detected.

B. Sludge/Soil Investigation

The sludge/soil investigation was conducted in two phases. Surface and subsurface soils were analyzed for TAL metals, cyanide, TCL VOCs, SVOCs, and PCBs/Pesticides. During phase I, samples were collected from a background location, the parking lot area, the former lagoon area, and the sludge drying bed area as shown in Figure 4. A total of 82 soil samples were collected from 12 boreholes (CMBH01 through CMBH12) at 5-foot intervals to a depth of 40 feet below land surface. Tables 5-9 show selected analytical results for soil samples collected from the boreholes.

TCL VOCs were found primarily in three of the boreholes located in the parking lot area (CMBH10, CMBH13, and CMBH16). The largest concentration of VOCs found in the soil occurred at 5 to 7 feet below land surface in CMBH10 (11,200 ug/kg). SVOCs (primarily PAHs) and pesticide compounds were detected in the upper portions of boreholes CMBH05, CMBH09, CMBH10, CMBH12, and CMBH16. Several boreholes indicated elevated levels of chromium, copper, and nickel down to 40 feet. Analytical results for phase I sludge samples CMSPG4A and CMSPE3A indicated elevated levels of chromium (24,000 mg/kg), nickel (11,000 mg/kg), zinc (2,000 mg/kg), copper (1,600 mg/kg), and cyanide

(40J mg/kg).

Based on the phase I sludge/soil analytical results, additional samples were collected during phase II from the parking lot area (see Figure 6), the former lagoon area (Figure 5), and the sludge drying bed area (see Figure 7 and Table 10). Eight subsurface soil samples (CMCP01 through CMCP08) were collected from the parking lot area south of the main building at depths from 6 to 10 feet below land surface and analyzed on-site with the GC to investigate the possible presence of residual VOC contamination. GC analytical results revealed elevated VOC levels in 5 boreholes, with a maximum TCE concentration of 17,000 ug/kg in sample CMCP02.

Based on the GC results, four samples (CMCP04, CMCP05, CMCP06, and CMCP07) were sent for off-site laboratory analysis through the EPA contract laboratory program (CLP). CLP analytical results confirmed 250 ug/kg of trichloroethene and 31 ug/kg of tetrachloroethene in sample CMCP06.

Five boreholes (CMBH13 through CMBH16) were installed at or near the four corners of the former lagoon to investigate the possible presence of residual inorganic contamination (Refer to Figure 5). The analytical results did not show a pattern of metals occurring in the soil; however, one sample (CMBH16, from 5-7 feet below land surface) contained chromium at 790 milligrams per kilogram (mg/kg). A number of samples contained polynuclear aromatic hydrocarbons (PAHs) and pesticides above background levels; however, concentrations did not exceed action levels.

A 50-foot grid was extended over the sludge drying bed area and the surrounding vicinity to investigate the nature and extent of metals contamination. A total of 168 surface and subsurface sludge/soil samples were collected from 46 grid points at one-foot intervals in the sludge drying bed area. The samples were analyzed on-site for the presence of chromium, nickel, copper, and zinc using a HNU X-ray fluorescence (XRF) analyzer.

Of the 23 surface soil samples collected, 8 samples in the western half of the grid indicated elevated metals concentrations. Chromium ranged from 1,350 mg/kg to 6,570 mg/kg (grid points A1 and Q1, respectively), and nickel ranged from 580 mg/kg to 3,010 mg/kg (grid points D2 and B1, respectively). In the eastern half of the grid, only two grid points, M7 and N7, indicated elevated metals concentrations. Chromium was present at 5,410 mg/kg and 23,120 mg/kg, respectively, and nickel was present at 860 mg/kg and 5,920 mg/kg, respectively. Cyanide was detected in 14 out of 20 surface soil samples, and concentrations ranged from 2.7J mg/kg (grid point J5) to 230J mg/kg (grid points B1 and M7).

Surface soil SVOC concentrations ranged from 44J ug/kg benzo-aanthracene (grid point I4) to 1,200 ug/kg benzo-(b and/or k)-fluoranthene (grid point E2). The largest number of SVOCs were found in a sample collected at E2, which contained 12 identified SVOCs, 10 TICs, and 3 unidentified compounds. Surface samples from four points (J7, J5, L7, and I4) contained seven, six, six, and five identified SVOCs, respectively. Samples from the remaining points detected from one to four identified SVOCs.

One SVOC, bis (2-ethylhexyl) phthalate, was detected in two sludge samples

at concentrations of 4,600 ug/kg (sample CMG3A) and 11,000 ug/kg (sample CMB226S).

One TIC was detected in sludge sample CMSPG3A, and unidentified SVOC compounds were detected in sludge samples CMSPB226S and CMSPG436S. Polynuclear Chlorinated Biphenols (PCBs) were detected in four sludge samples corresponding to grid locations B2 (2.1 mg/kg), E3 (0.32J mg/kg), G4 (1.10 mg/kg), and M7 (0.021 mg/kg). Pesticides were detected in six surface soil samples.

In the western half of the grid, 66 subsurface soil samples were collected at 22 sample locations. Three grid points (points B2, G4, E3) directly overlaid subsurface sludge drying beds. Sludge was encountered at depths of 26, 36, and 42 inches below land surface below these three grid points, respectively. Samples were collected at the three locations to characterize the nature of the sludge. Chromium concentrations ranged from 100,000 mg/kg to 27,000 mg/kg (points E3 and G4, respectively), and nickel ranged from an estimated 36,000 mg/kg to 10,000 mg/kg (points E3 and G4, respectively). Based on the results of the XRF analyses, 20 samples were sent for CLP analysis for metals, cyanide, TCL VOCs, TCL SVOCs, and PCBs/Pesticides. CLP analytical results confirm the XRF analysis, indicating a general pattern of elevated metals in surface samples in certain grid areas.

Subsurface soil samples from depths below the sludge drying beds were collected and analyzed both by XRF analysis and CLP analysis. CLP analysis of seven samples, including samples collected at depths below the sludge drying beds, did not indicate elevated metals concentrations.

Two sludge samples were also submitted for toxicity characteristic leaching procedure (TCLP) analysis. The TCLP analysis indicated that chromium leaching ranged from 0.29 to 0.71 mg/kg; no other metals leached above their respective detection limit (See Table 11).

C. Surface water/Sediment Investigation

Surface water and sediment samples were collected on two separate occasions during the RI. The first sampling event occurred in January 1991 during the wet season. Four surface water and sediment samples (CMSW01 through CMSW04 and CMSD01 through CMSD04, respectively) were collected, one from a background location (CMSW/SD04), two from locations adjacent to the Site (CM/SD01 and CM/SD02), and one from a location downstream from the Site (CMSW03, CMSD03). See Figure 8.

In general, metals data from the background location indicate that sediment samples should generally contain less than 25 mg/kg of chromium, cobalt, copper, lead, and nickel. There is little indication of the presence of arsenic, cadmium, and mercury in the sediment background samples. VOC and SVOC results were negative. Cyanide was found in background sample CMSW04 at 6.2 ug/l. Refer to Table 12 for selected analytical results.

Barium and zinc appear to be naturally occurring at fairly substantial levels (100 to 200 mg/kg) in the sediments. Surface water samples at all four locations were clean, except for the water sample taken from the stagnant pool at CMSW05, which contained lead at 53 ug/l.

Sample CMSW/SD02 revealed the presence of VOCs. It is not known if the source of this contamination is due to groundwater discharge or from chemicals in the soil gas that have escaped from the underlying groundwater plume. Sample CMSW03 showed a slightly elevated concentration of chromium (31 ug/l), while CMSD03 revealed 12J mg/kg of cyanide.

The second sampling event included collecting seven surface water and ten sediment samples during the dry season in September 1991. Sampling locations included one background sample (CMSW/SD05), two samples adjacent to the Site (CMSW/SD13, CMSW/SD14), and the remaining samples downstream. Refer to Figure 7. Sample CMSW/SD13 indicated the presence of the VOCs 1,2dichloroethene (91 ug/l), trichloroethene (32J ug/l), tetrachloroethene (8J ug/l), and chloroform (4J ug/l); these results confirm the fact that VOCs occurred in sample CMSW/SD02 collected in January 1991.

Sample CMSW12, located immediately downgradient of the Site, revealed the presence of barium (20 ug/l) and toluene (3J ug/l), while CMSD12 revealed chromium (62 mg/kg), copper (31 mg/kg), and nickel (23 mg/kg) above expected background levels. Eight unidentified SVOCs were measured at a total concentration of 7 mg/kg; and one TIC was identified (bromohexane at 900JN ug/kg). Samples CMSW/SD08, CMSW/SD09, CMSW/SD10, and CMSW/SD11 were collected south of the railroad tracks. Samples CMSW/SD08, CMSW/SD09, and CMSW/SD10 revealed various concentrations of chromium, copper, nickel, and cyanide. No volatiles were identified in the four samples; however, seven unidentified SVOCs with a total concentration of 6 mg/kg were identified in sample CMSD11. Two pesticides were identified in sample CMSD09 (4,4-DDD, 8.5 ug/kg and 4,4-DDE, 2.7J ug/kg).

VI. SUMMARY OF SITE RISKS

The JFD Electronics/Channel Master Site is releasing contaminants into the environment. The Baseline Risk Assessment presents the results of a comprehensive risk assessment that addresses the potential threats to public health and the environment posed by the Site under current and future conditions if no remedial action is taken at the Site. Actual or threatened releases from the Site, if not addressed, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The Baseline Risk Assessment consists of the following sections: identification of chemicals of potential concern; toxicity assessment; human exposure assessment; risk characterization; and environmental assessment. All sections are summarized below.

A. Contaminants of Concern

Data collected during the RI were reviewed and evaluated to determine the contaminants of concern at the Site which are most likely to pose risks to public health or the environment. These contaminants were chosen for each environmental media sampled. Table 13 shows chemicals of potential concern for soil/sediment and Table 14 for groundwater and surface water.

Once these contaminants of concern were identified, exposure concentrations in each media were estimated. The maximum concentrations detected were

compared to the calculated 95% confidence level of the arithmetic average of all samples, and the lower of these values was chosen as the estimated exposure concentration. Table 15 shows the exposure parameters used to derive the chronic daily intake.

B. Exposure Assessment

The exposure assessment identified potential pathways and routes for contaminants of concern. Two overall exposure conditions were evaluated. The first was the current land use condition, which considers the Site as it currently exists.

The second was the future land use condition, which evaluates potential risks that may be associated with any probable change in Site use assuming no remedial action occurs.

The exposure pathways that were evaluated under current land use conditions were as follows:

- . Incidental ingestion and dermal absorption of surface soil/sludge in the sludge drying bed area by facility workers;
- . Incidental ingestion and dermal absorption of shallow soil/sludge in the sludge drying bed area by utility workers; and
- . Incidental ingestion and dermal absorption of shallow soil/sludge in the main building area by facility workers.

The exposure pathways that were evaluated under future land use conditions were:

- . Incidental ingestion and dermal absorption of surface soil/sludge in the sludge drying bed area by child or adult residents;
- . Incidental ingestion and dermal absorption of shallow soil/sludge in the main building area by child and adult residents;
- . Incidental ingestion and dermal absorption of creek sediment by child and adult residents;
- . Dermal absorption of creek surface water by child and adult residents;
- . Dermal absorption and inhalation of volatile chemicals in shallow/intermediate groundwater by child and adult residents while showering;
- . Dermal absorption and inhalation of volatile chemicals in bedrock groundwater by child and adult residents while showering;
- . Ingestion of shallow/intermediate groundwater by child and adult residents; and
- . Ingestion of bedrock groundwater by child and adult residents.

C. Toxicity Assessment

Under current EPA guidelines, the likelihood of adverse effects to occur in humans from carcinogens and noncarcinogens are considered separately. These are discussed below. The toxicity of the contaminants of concern are presented in "IRIS" - EPA's Toxicity Data base.

Carcinogens

EPA uses a weight of evidence system to classify a chemical's potential to cause cancer in humans. All evaluated chemicals fall into one of the following categories:

Group A chemicals - known human carcinogen

Group B chemicals - probable human carcinogen

B1 chemicals - limited human epidemiological evidence

Group C chemicals - possible human carcinogens

Group D chemicals - not classified to human carcinogenicity

Group E chemicals - evidence of noncarcinogenicity in humans

Noncarcinogens

Health criteria for chemicals exhibiting noncarcinogenic effects are generally developed using verified risk reference doses (RfDs) and reference concentrations (RfCs). These are developed by USEPA's RfD/RfC Work Group or are obtained from the Agency's IRIS data base or Health Effects Assessment Summary Table (HEAST). The RfDs, expressed in units of mg/kg/day, are lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

D. Risk Characterization

Table 16 shows the final contaminants of concern for the media of concern. To quantitatively assess the risks of these contaminants from the Site, the chronic daily intakes (CDIs) were combined with the health effects criteria.

For potential carcinogens, excess lifetime upperbound cancer risks were obtained by multiplying the estimated CDI for each chemical by its cancer slope factor. The total upperbound excess lifetime cancer risk for each pathway was obtained by summing the chemical-specific risk estimates. A cancer risk level of 1×10^{-6} represents an upper bound probability of one in one million that an individual could develop cancer due to exposure to the potential carcinogen under the specified exposure conditions.

Potential risks for noncarcinogens are presented as the ratio of the CDI to the reference dose for each chemical. The sum of the ratios of all

chemicals under consideration is called the hazard index. The hazard index is useful as a reference point for gauging that the potential exists for adverse health effects to occur from the assumed exposure pathways and durations, and that remedial action may be warranted for the Site.

Table 17 summarizes the quantitative estimates of carcinogenic and noncarcinogenic risk under the current and future land use scenario for each exposure pathway evaluated in the risk assessment, respectively.

E. Environmental (Ecological) Risk

Potential risks to environmental receptors at or near the Site were evaluated based on Site sampling data and a review of the toxicity of the chemicals of potential concern to ecological receptors. Use of the Site, particularly the sludge drying bed area or the main building area, by terrestrial receptors such as birds and small mammals was considered unlikely, given the lack of trees or other cover at the Site. Therefore, the focus of the ecological assessment was on the intermittent creeks east and south of the site and the small low-lying area south of the railroad tracks. Although these creeks do not contain sufficient water to sustain fish populations, populations of aquatic insects could occur there.

Ambient water quality criteria are considered inappropriate for the limited aquatic receptors at this Site, because they incorporate toxicity data from sensitive fish species such as trout that would not occur in these creeks. Therefore, potential impacts to the aquatic receptors at the Site were evaluated by comparing average and maximum surface water concentrations with invertebrate aquatic toxicity data. Potential impacts from exposure to sediment were evaluated by comparing average and maximum sediment concentrations with sediment toxicity values. Based on these comparisons, it is possible that the presence of elevated levels of sodium in surface water may be impacting freshwater aquatic life, especially in the creek to the south of the Site. It is also possible that some sensitive aquatic invertebrates could be adversely affected by chromium, nickel, and some PAHs present in the sediment at sample locations such as CMSD06. Limited cover at the Site limits its value as habitat for terrestrial species. Based on a qualitative analysis, terrestrial wildlife communities in the lowlying and wooded areas near the Site are not likely to be significantly impacted.

Additional sampling of the intermittent creeks and the downstream tributary is needed during the Remedial Design to define the downstream extent of surface water or sediment contamination. A rapid bioassessment and surface water/sediment toxicity testing is also needed to determine if remedial action is warranted.

VII. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(D) of CERCLA, as amended by SARA, requires that remedial actions comply with requirements or standards set forth under Federal and State environmental laws. The applicable or relevant and appropriate requirements (ARARs) that must be complied with are those that are (A) actionspecific, (B) location-specific, or (C) chemical-specific at the Site. Thus, ARARs are used to determine the appropriate extent of Site cleanup, to scope and formulate remedial action alternatives, and to govern the implementation and

operation of the selected action. "To be considered" materials (TBCs) are nonpromulgated, non-enforceable advisories, guidelines, or criteria issued by federal or state governments (e.g., reference doses and carcinogenic potency factors) that may be useful for developing remedial action alternatives or for determining what is protective to human health and the environment.

A. Action-Specific ARARs

Action-specific requirements set controls or restrictions on the design, performance, and other aspects of implementation of specific remedial activities. A retained alternative must conform with all ARARs unless a statutory waiver is invoked. The action-specific ARARs pertaining to the Site include:

Resource Conservation and Recovery Act (as amended) (42 U.S.C. SS 6921-6939 (S 3001-3019); 40 C.F.R. Parts 260-71) Regulates the treatment, storage, and disposal of hazardous waste from generation through ultimate disposal,

Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels (MCLs), (42 U.S.C. S 1412 (S 300g-1); 40 C.F.R. 141.11, 141.61) Establishes primary MCLs adopted for the protection of human health but include an analysis of feasibility and cost of attainment,

SDWA Secondary Maximum Contaminant Levels (SMCLs), (42 U.S.C. S 1412 (S 300g-1); 40 C.F.R. 143.3) Establishes unenforceable secondary MCLs regulating the aesthetic quality of drinking water,

SDWA Maximum Contaminant Level Goals (MCLGs), (42 U.S.C. S 1412 (S 300g-1); 40 C.F.R. 141.50) Establishes unenforceable MCL goals based on health criteria and used for the nation's water supply,

Clean Water Act (CWA) Discharge Limitations, (33 U.S.C. S 1311 (S 301); 40 C.F.R. Parts 122, 125, 129, 133, and 136) Requires the use of best available technology economically achievable to control discharge of toxic pollutants to POTW,

CWA Pretreatment Standards, (33 U.S.C. S 1317 (S 307); 40 C.F.R. 403.5) Prohibits the unpermitted discharge of any pollutants or combinations of pollutants to waters of the U.S. from any point source,

Department of Transportation (DOT) Hazardous Materials Transportation Act (49 U.S.C. SS 1801-12; 49 C.F.R. Parts 107, 171-179) Regulates the labelling, packaging, placarding, and transport of hazardous materials offsite,

Occupational Safety and Health Administration (OSHA) (29 U.S.C. S 651 et seq.; 29 C.F.R. Parts 1910.120, (.1000-.1500), and 1926.53, (.650-.653)), Occupational safety and health requirements (1910.120) for hazardous substance response actions under CERCLA establish safety and health program requirements that must be implemented in the cleanup phase of a CERCLA response. These standards govern CERCLA response actions involving any type of hazardous substance that may result in adverse effects on employee health and safety. The provisions of 29 C.F.R. 1926.650-.653 are applicable to any

excavation, trenching, and shoring that is undertaken as part of the construction of trenches, cut-off walls, etc.,

North Carolina Hazardous Waste Management Regulations (NCAC, Title 15A, Chapter 13A, Sections .0009, .0013), Provides standards for owners/operators of hazardous waste treatment, storage, and disposal facilities,

North Carolina Solid Waste Disposal Regulations (NCAC, Title 15A, Chapter 13B), Provides design, operation, and closure requirements for solid waste disposal facilities,

North Carolina Groundwater Standards (NCAC, Title 15A, Subchapter 2L), Establishes groundwater restoration goals and criteria for termination of restoration activities,

North Carolina Water Quality Standards (NCAC, Title 15A, Subchapter 2B), Establishes effluent limitations, in terms of both quantity and quality, for point discharges to surface water bodies,

Wastewater Discharge to Surface Waters (NCAC, Title 15A, Subchapter 2H), Regulates surface water discharge and discharges to POTW,

Clean Air Act (CAA) National Ambient Air Quality Standards (42 U.S.C. S 109 (S 7409); 40 C.F.R. Part 50), Establishes emissions standards, monitoring and testing requirements, and reporting requirements for eight pollutants in air emissions,

CAA New Source Performance Standards (42 U.S.C. S 7411 (S 111); 40 C.F.R. 60), Establishes standards of performance for new air emission sources,

North Carolina Air Pollution Control Requirements (NCAC, Title 15A, Subchapter 2D), Regulates air pollution, air quality, and emissions standards, and

North Carolina Sedimentation Control Rules (NCAC, Title 15A, Subchapter 4) Provides requirements for the prevention of sedimentation pollution.

B. Location-Specific ARARs

Location-specific ARARs must consider Federal, State, and local requirements that reflect the physiological and environmental characteristics of the Site or the immediate area. Remedial actions may be restricted or precluded depending on the location characteristics of the Site and the resulting requirements. The location-specific ARARs pertaining to the Site include:

Classifications and Water Quality Standards Applicable to the Surface Waters of North Carolina (NCAC 15A, Subchapter 2B) Establishes surface water classifications for unnamed tributary near Site, Fishing Creek, and Tar River,

RCRA Locations Standards (42 U.S.C. SS 6921-6939 (S 3001-3019; 40 C.F.R. Parts 257, 264.18) A TSD facility must be designed, constructed, operated, and maintained to avoid washout along a 100-year floodplain. These requirements have been adopted by the state of North Carolina, and are

covered in the North Carolina Hazardous Waste Management Regulations,

North Carolina Hazardous Waste Management Regulations (NCAC, Title 15A, Subchapter 13A, Section .0009) Establishes siting and design requirements for hazardous waste treatment, storage, and disposal facilities,

North Carolina Solid Waste Disposal Regulations (NCAC, Title 15A, Chapter 13B, Section .0503) Establishes siting and design requirements for solid waste disposal sites,

CAA National Ambient Air Quality Standards (NAAQSs) (42 U.S.C. S 7409 (S 109); 40 C.F.R. Part 50) Establishes emission standards to protect public health and public welfare,

Fish and Wildlife Coordination Act (16 U.S.C. 661-666), Requires actions to protect fish and wildlife from actions modifying streams or affecting streams,

Floodplain Management Executive Act, (Executive Order 11988; 40 C.F.R. 6.302), Enforces that actions that are to occur in a floodplain should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial value, and

North Carolina Sedimentation Pollution Control Act (General Statistics of North Carolina, Chapter 113A, Article 4), Establishes mandatory standards for control of sedimentation and erosion in streams and lakes.

C. Chemical-Specific ARARs

Chemical-specific ARARs are concentration limits in the environment promulgated by government agencies. Health-based site-specific levels must be developed for chemicals or media where such limits do not exist and there is a concern with their potential health or environmental impacts. Groundwater cleanup levels for the Site are Safe Drinking Water Act Maximum Contaminant Levels (MCLs) or North Carolina water quality standards, whichever are more protective. These groundwater levels are shown in Table 18. The potential chemicals specific ARARs pertaining to the Site include:

SDWA MCLs (42 U.S.C. S 1412 (S 300g-1); 40 C.F.R. Parts 141.11, 141.61), Establishes health-based standards for public water systems, for inorganics and organics, respectively.

CWA Water Quality Criteria (33 U.S.C. S 1314(a)(1)(S 304)(a)(1); 40C.F.R. Part 131), Sets criteria for water quality based on toxicity to aquatic organisms and human health,

RCRA (42 U.S.C. SS 6921-39 (SS 3001-19); 40 C.F.R. Parts 260-271), Regulates the treatment, storage, and disposal of hazardous waste from generation through ultimate disposal, as well as the protection of groundwater at solid waste management units,

CAA National Emissions Standards for Hazardous Air Pollutants (NESHAPS) (42 U.S.C. S 109 (S 7409); 40 C.F.R. Part 61), Provides emission standards for hazardous air pollutants for which no ambient air quality standard exists,

and may be relevant and appropriate if on-site treatment units are part of the remedial action,

CAA National Ambient Air Quality Standards (NAAQSs) (42 U.S.C. S 109 (S 7409); 40 C.F.R. Part 50), Sets primary and secondary air standards at levels to protect public health and public welfare, and may be relevant and appropriate if on-site treatment units are part of the remedial action,

DOT Hazardous Materials Transportation Act (49 U.S.C. SS 1801-12; 40 C.F.R. Parts 107, 171-9), Regulates the labeling, packaging, placarding, and off-site transportation of specific hazardous chemicals and wastes,

OSHA (29 U.S.C. S 651; 29 C.F.R. 1910, Part 120), Sets limits on exposure to workers on hazardous site or emergency responses, sets minimum health and safety requirements such as personal protection and training, and reporting requirements,

North Carolina Groundwater Standards (NCAC, Title 15A, Subchapter 2L, Section .0202), Establishes groundwater classification and water quality standards,

North Carolina Drinking Water Act (130A NCAC 311-327) Regulates water systems within the State which supply drinking water that affect public health, North Carolina Comprehensive Environmental Response Act (130A 310.1-310.23),

North Carolina Surface Water Quality Standards (NCAC, Title 15A, Subchapter 2B) Establishes water quality requirements applicable to all surface waters of North Carolina which protect public health and the environment,

North Carolina Air Pollution Control Requirements (NCAC, Title 15A, Subchapter 2D), and

North Carolina Solid and Hazardous Waste Management Act (130A NCAC).

To be Considered Materials (TBCs)

"To be considered" materials (TCBs) are non-promulgated, nonenforceable advisories, guidelines, or criteria issued by federal or state governments that may be useful for developing remedial action alternatives or for determining what is protective to human health and the environment. The following are several examples of TBCs for the Site:

EPA Groundwater Protection Strategy (EPA 1984), Whose policy is to protect groundwater for its highest present or potential beneficial use. This policy will be incorporated into future regulatory amendments, and

National Oceanic and Atmospheric Administration (NOAA) ER-L/ER-M Values, Guidelines developed as screening criteria for sediment to be protective of aquatic life.

Sludge/Soil Cleanup Levels

There are no promulgated Federal or State standards applicable to the

contaminants in the sludge/soil at the Site. Cleanup levels have been calculated based on direct exposure residential assumptions for contamination identified in the sludge/soil. These levels are at the 10⁻⁶ end of the protective risk range (risk that one person in one million people would experience adverse health affects). These levels were adopted as per OSWER Directive 9355.0-30.

Directive 9355.0-30 states that remedial action is warranted under CERCLA where the Baseline Risk Assessment indicates that Site risk to an individual exists. It was determined that the Site's future land use possibilities should include a residential scenario where a home with a basement is constructed. Based on this scenario, the reasonable maximum exposure for both current and future land use for the Site indicates that the noncarcinogenic hazard quotient exceeds 1 for chromium, nickel, and antimony in those areas shown in Figure 8. The total quantity of contaminated sludge/soil to be remediated is estimated to be 3,000 yards.[3].

In order to be protective of human health using the residential scenario, it was determined that cleanup levels for sludge/soil would be calculated based on direct exposure and would be applied to sludge/soil at depth. The health-based sludge/soil cleanup levels are identified in Table 19. This table also indicates the range of detected concentrations for those metals whose hazard index exceeded 1.

The remediation levels are based on direct exposure to contaminated sludge/soil via incidental ingestion and dermal contact. The following equation and exposure assumptions were used to calculate the remediation or cleanup levels for chromium, nickel, and antimony. All chromium present is assumed to be in the hexavalent state.

THI * AT * BW

$$EF * ED * [(1/Rfd[o] * FI * IR * CF) + (1/Rfd[a] * SA * AF * AB * CF)]$$

where: THI = Target Hazard Index = 1

AT = Aver. time = 2,190 days (child), 8,760 (adult)

BW = Body Weight = 15 kg (child), 70 kg (adult)

EF = Exposure Frequency = 350 days/year

ED = Exposure Duration = 6 yrs. (child); 24 yrs. (adult)

Rfd[o] = Oral Reference Dose (mg/kg-day)

FI = Fraction Ingested = 1

IR = Ing. Rate = 200 mg/day (child); 100 mg/day (adult)

CF = Conversion Factor = 1E-06 kg/mg

Rfd[a] = Adjusted Rfd[o] (5% oral absorp. eff.) [mg/kg-day]

SA = Surface are = 3,140 cm² (child); 3,120 cm² (adult)

AF = Soil to Skin Adherence Factor = 1 mg/cm²

ABS = Dermal Absorption Factor = 0.001

VIII. DESCRIPTION OF ALTERNATIVES

Table 20 summarizes the technologies considered for remediating the groundwater and sludge/soil contamination, respectively, at the JFD Electronics/Channel Master Site. These tables also provide the rationale as to why certain technologies were not retained for further consideration

after the initial screening.

A. Remedial Alternatives to Address Groundwater Contamination

These groundwater alternatives were developed to address groundwater contamination at the Site:

Alternative 1: No Action

Alternative 2: Alternate Water Supply, Closure of Private Wells, Deed Restrictions, Monitoring

Alternative 3: Groundwater Extraction, Treatment with Ultraviolet Radiation-Oxidation, and Precipitation/Filtration

Alternative 4: Groundwater Extraction, Treatment with Alkaline Chlorination, Precipitation/Filtration, Air Stripping, and Carbon Adsorption

Alternative 5: Groundwater Extraction, Treatment with Alkaline Chlorination, Ion Exchange, Air Stripping, and Carbon Adsorption

The remedial response actions to address groundwater contamination are discussed below.

Alternative 1: No Action

No remedial action would be implemented for groundwater contamination under this alternative. The No Action alternative would include the posting of warning signs, a 5-year review of the remedy, as well as the initiation of a public awareness program.

This alternative involves the following costs:

Total Capital Costs	\$170,000
Total O & M Costs	\$329,000
Total Present Worth Costs	\$499,000

Alternative 2: Institutional Actions - Alternate Water Supply, Closure of Private Wells, Deed Restrictions, Monitoring

Alternative 2, considered a "limited action" response, is considered a site-wide remedial action. This alternative would involve not only closing existing private wells, but supplying an alternate water supply for those potentially affected drinking wells located downgradient from the Site. Establishing deed restrictions would prohibit the drilling of new water supply wells and the use of existing groundwater in the area potentially affected by the Site. Monitoring of existing water supply wells located outside the area of deed restrictions would enable early detection of any site-related contamination.

The reduction of groundwater contaminants to acceptable levels would occur only through natural processes, thus requiring many years before cleanup levels would be met.

This alternative involves the following costs:

Total Capital Costs	\$524,000
Total O & M Costs	\$398,000
Total Present Worth Costs	\$922,000

Alternative 3: Collection/Treatment/Disposal - Groundwater Extraction, Treatment with Ultra-violet Radiation-Oxidation and Precipitation/Filtration

This alternative would involve the recovery of groundwater such that the remediation levels would be attained. Contamination would be removed through extraction wells placed in contaminated portions of the overburdenbedrock aquifer and reduced through treatment by Ultraviolet Radiation and Precipitation/Filtration. Discharge of the treated groundwater would be either to the local Publicly-owned Treatment Works (POTW) or to a nearby, unnamed branch of Fishing Creek. All contaminants in the groundwater would be reduced to levels which would be acceptable by local POTW standards or to levels required by a NPDES permit.

The proposed extraction system (as with Alternatives 4 and 5) would involve the installation of an estimated six recovery wells arranged in such a manner to extract all VOC-contaminated groundwater and to control any further off-site migration of the contaminated groundwater. The exact number of extraction wells would be determined during the Remedial Design.

The use of Ultraviolet Radiation, along with oxidizing agents such as hydrogen peroxide and ozone, are a proven technology for destroying dissolved organic contaminants as well as a host of other contaminants including cyanide.

Precipitation/Filtration (or flocculation) is also a proven physiochemical process whereby inorganic substances in solution are transformed into solids and removed from the liquid waste stream by forcing the groundwater through a porous substance acting as the filter media. The technology is based upon alternation of the chemical equilibrium relationships affecting the solubility of an inorganic species. Removal of metals as hydroxides or sulfides is the most common precipitation application in wastewater treatment. Precipitation is applicable to the removal of most metals from wastewater, includingzinc, cadmium, chromium, copper, lead, manganese, and mercury. Certain anionic species as phosphate, sulfate, and fluoride can also be removed.

Precipitation and Filtration are well-established technologies. Precipitation/Filtration equipment is relatively simple, readily available, easy to operate and control, and integrates with other treatment technologies. Several disadvantages are that residual sludge waste would be generated from the treatment process and sent off-site to a RCRA treatment, storage, and disposal (TSD) facility in full compliance with its Part B permit, in accordance with EPA's off-site policy. The process is non-selective in that compounds other than those targeted may be removed.

Discharge of the treated groundwater would be to the local POTW or to a nearby, unnamed tributary of Fishing Creek. The actual method of discharge and operating parameters would be established by the party performing the work during the Remedial Design.

Further characterization would be conducted during the Remedial Design phase to determine the full extent of groundwater contamination. This characterization would be necessary for groundwater alternatives 3, 4, and 5 prior to drafting a detailed design for the groundwater pump-and-treat system at the Site. To achieve this characterization, the installation of additional monitoring wells would be necessary. The costs for these additional wells were not included in this ROD.

This alternative involves the following costs:

Total Capital Costs	\$2,657,000
Total O & M Costs	\$1,852,000
Total Present Worth Costs	\$4,509,000

Alternative 4: Collection/Treatment/Disposal - Groundwater Extraction, Treatment with Alkaline Chlorination, Precipitation/Filtration, Air Stripping, and Carbon Adsorption

Alkaline Chlorination is a proven technology for destroying both VOCs and cyanide in groundwater with the use of chlorine compounds such as sodium hypochlorite and chlorine gas.

Precipitation/Filtration would be used to transform inorganic substances in groundwater into solids and remove them from the liquid waste stream by forcing the groundwater through a porous substance. As described for alternative 3, sludge would be generated from this treatment and would be sent offsite for disposal in compliance with all ARARs listed in section VII.

Air Stripping is the mass transfer process whereby volatile contaminants are transferred from their combined state to a gaseous state. Four commonly used methods for air stripping liquids are packed column, cross-flow tower, coke tray aerator, and diffused air basin procedures. Air stripping is most commonly accomplished using a packed tower equipped with an air blower. The packed tower works on the principle of counter-current flow where the water stream flows down through the packing material while the air is blown upward, and is exhausted through the top. Volatile, soluble compounds have an affinity for the gaseous phase.

In the cross-flow tower, water flows down through the packing as in the counter-current packed column; however, the air is pulled across the water flow by a fan. The coke tray aerator is a simple, low maintenance process requiring no blower. The water being treated is allowed to trickle through several layers of trays. This produces a large surface area for gas transfer.

Diffused aeration stripping and induced draft stripping use aeration basins similar to standard wastewater treatment aeration basins. Water flows through the basin from top to bottom of the basin. The air to water ratio is significantly lower in either the packed column or the cross-flow tower units.

Air stripping is normally utilized to remove volatile organics from aqueous

waste streams. Generally components with Henry's Law constants greater than 0.003 can be effectively removed by air stripping. The waste feed stream must be low in suspended solids and may require Ph adjustments to reduce solubility and improve transfer to the gaseous phase.

Air stripping is sometimes only partially effective in groundwater treatment and must be followed by other processes such as carbon adsorption or biological treatment. The combined use of air stripping followed by other applicable processes can be an effective means of removing the contaminants from groundwater. Equipment for air stripping is relatively simple, start-up and shut-down can be accomplished quickly, and the modular design of packed towers makes them somewhat mobile in their application.

An important consideration in the utilization of the air stripping technology are the implications of the air pollution which may result from the air stripping operation itself. The gaseous stream generated during air stripping may require collection and subsequent treatment.

The process of adsorption onto activated carbon involves contacting a waste stream with the carbon, normally by flow through a packed bed reactor. The activated carbon process can be designed to selectively adsorb hazardous constituents by a surface attraction phenomenon in which organic molecules are attracted to the internal pores of the carbon granules.

Adsorption depends upon the strength of the molecular attraction between the adsorbent substance and absorbate, molecular weight, type and characteristics of the adsorbent substance, electrokinetic charge, pH, and surface area. Once the micropore surfaces are saturated with organics, the carbon is spent and must either be replaced with virgin carbon or removed, thoroughly regenerated, and replaced.

The time to reach breakthrough or exhaustion is the single most critical operating parameter. Carbon longevity balanced against influent concentration governs operating economies. In the event that the carbon is regenerated on-site, the supernatant from this process will be processed through the system constructed for treating the Site groundwater.

Activated carbon adsorption is a well-developed technology which is widely used in the treatment of hazardous waste streams. It is especially well suited for the removal of mixed organics from aqueous wastes. Since carbon adsorption is an electrical interaction phenomenon, the polarity of the waste compounds will determine the effectiveness of the adsorption process.

The more hydrophobic (insoluble) a molecule is, the more readily the compound is adsorbed. As a result, low solubility humic and fulvic acids which are present in the groundwater can adsorb to the activated carbon more readily than any waste contaminants and result in rapid carbon exhaustion. Also, some metals and inorganic species have shown excellent to good adsorption potential. These include antimony, arsenic, bismuth, chromium, tin, silver, mercury, cobalt, zirconium, chlorine, bromine, and iodine. Activated carbon can also be utilized in the powdered form, which offers the advantages of greatly increased surface area availability and reduced costs.

Carbon adsorption technology can be used in conjunction with or flowing

biological treatment and/or gravity filtration. Its purpose in this application is to remove the refractory organics which cannot be biologically degraded.

The biological treatment and/or granular media filtration steps prior to carbon adsorption reduce the organic and suspended solids load to the carbon adsorption units. Reduction of organic and suspended solid load minimizes carbon usage and regeneration costs. Air stripping has also been applied prior to carbon adsorption in order to reduce a portion of the volatile contaminants and reduce the organic load to the carbon adsorption units.

Activated carbon usage is easily implemented into or along with other treatment systems. The process is well suited to mobile units as well as to on-site construction. Space requirements are small and start-up and shutdown are rapid.

Regeneration of spent carbon for use is the highest operating cost associated with the utilization of carbon adsorption technology. In addition, high capital costs can be associated with its use. Both capital and operating costs can be substantially reduced through pretreatment of the waste prior to its treatment with carbon adsorption.

Activated carbon treatment would not be utilized as a primary remedial technology role at the Site, but would be used as a supplementary technique in conjunction with other clean-up technologies. This technology will be retained for further consideration.

Treated groundwater would be discharged either to the local POTW or a nearby tributary of Fishing Creek.

Costs for this alternative are based on discharge to the local POTW as well as a remediation period of at least five years.

This alternative involves the following costs:

Total Capital Costs	\$2,498,000
Total O & M Costs	\$2,683,000
Total Present Worth Costs	\$5,181,000

Alternative 5: Collection/Treatment/Disposal - Groundwater Extraction, Treatment with Alkaline Chlorination, Ion Exchange, Air Stripping, and Carbon Adsorption

Alternative 5 would include the same treatment except Ion Exchange would be substituted for Precipitation/Filtration.

Ion Exchange is a process where the toxic ions present in a waste stream are removed by being exchanged with relatively harmless ions held by the ion exchange material. Ion exchange resins are primarily synthetic organic materials containing ionic functional groups to which exchangeable ions are attached. These synthetic resins are structurally stable (can tolerate a range of temperature and pH), exhibit a high exchange capacity, and can be utilized to selectively exchange ions..

This technology can be used to remove a wide range of inorganic species from water. These include: all metallic elements when present as soluble species (either anionic or cationic); inorganic anions such as halides, sulfates, nitrates, cyanides; organic acids such as carboxylics, sulfonics, and some phenols; and organic amines.

Ion exchange is a well established technology for heavy metal removal and hazardous anion removal from dilute waste solutions. A problem which exists with ion exchange is the disposal of contaminated regeneration solutions. Consideration should be given to selection of these solutions when evaluating the technology. Based on the data available for this screening, the contaminants present, amenability of other treatment technologies, and costs, ion exchange is not being considered for further evaluation as a remedial technology at the Site.

This alternative involves the following costs:

Total Capital Costs	\$2,539,000
Total O & M Costs	\$2,786,000
Total Present Worth Costs	\$5,325,000

B. Remedial Alternatives to Address Sludge/Soil Contamination

The response actions to address sludge/soil contamination are:

Alternative 1: No Action

Alternative 2: Fencing, Warning Signs, Deed Restrictions, Capping

Alternative 3: Excavation and Off-site Disposal

Alternative 4: Excavation, Treatment with Oxidation-Reduction, Stabilization, On-site Disposal, Capping

Alternative 5: Excavation, In-situ Vittrification, On-site Disposal, Capping

Each of the five alternatives is described below.

Alternative 1: No Action

In this alternative, no sludge or soil remediation would occur. The costs associated with this alternative are the same as the costs shown for Alternative 1 for the groundwater remediation. These costs include:

Total Capital Costs	\$170,000
Total O & M Costs	\$329,000
Total Present Worth Costs	\$499,000

Alternative 2: Institutional Actions - Fencing, Warning Signs, Deed Restrictions, Capping

This alternative would include fencing of the Site to limit access to the property, as well as posting warning signs to identify the property as an EPA Superfund hazardous waste site. Deed restrictions would also be

established to limit land and groundwater use in the area of contamination.

Prolonged monitoring of the contamination would be implemented. A cap would be placed over the sludge drying bed area to reduce the possibility for physical contact with contaminants, the possibility for airborne contamination, as well as the possibility for contamination of surface water and sediments. The exact nature of the cap would depend on the results of the treatability studies performed during the Remedial Design phase.

Total Capital Costs	\$524,000
Total O & M Costs	\$398,000
Total Present Worth Costs	\$922,000

Alternative 3: Excavation and Offsite Disposal

Alternative 3 would include excavating the contaminated sludge and soil and transporting the material off-site to an approved RCRA treatment, storage, and disposal (TSD) facility. The sludge and soil is classified as a mixture of RCRA - F006 and F019 Listed Waste, and would therefore be regulated as such by the Land Disposal Restrictions (LDRs), (40 CFR 268). Trucks would be loaded by conventional earthmoving equipment. Once the trucks are loaded, a cover would be installed over the material, and the trucks would be transferred to a decontamination facility for final cleaning and inspection prior to transport. The total quantity of contaminated sludge and soils to be removed is estimated to be 3,000 yd³, which would require approximately 230 truckloads to complete the off-site transporting of the material.

Once all contaminated sludge and soil is removed from the Site and the excavated area is backfilled with clean fill and topsoil, a vegetative cover would be established and the area could be opened for unrestricted use. The time required for excavation and off-site disposal of the sludge and soil may be determined by local authorities and their restrictions on truck traffic or by the disposal facility's processing capabilities. At a disposal rate of 5 trucks per day, the disposal would take approximately 2 months.

Total Capital Costs	\$2,363,000
No O & M Costs	0
Total Present Worth Costs	\$2,363,000

Alternative 4: Excavation, Treatment with Oxidation-Reduction, Stabilization, On-site Disposal, Capping

Alternative 4 would include excavating the contaminated sludge and soil, treating the material with Oxidation-Reduction and Stabilization, and backfilling the solidified material into the excavated area. No lateral expansion of the area of concern will occur.

Oxidation-Reduction is a type of treatment whereby contaminants undergo a chemical process to either destroy or convert each constituent to a less hazardous form.

Stabilization and solidification are terms which are used to describe a type

of treatment which accomplishes one or more of the following objectives:

- . improve waste handling or other physical characteristics of a waste;
- . decrease the surface area from which transfer or loss of contained pollutants can occur; and
- . limit the solubility or toxicity of hazardous waste constituents.

Stabilization is used to describe processes whereby one of the aforementioned objectives are obtained by production of a monolithic block of waste with high structural integrity. The contaminants do not necessarily interact chemically with the resulting solidification reagents, but are mechanically locked within the solidified matrix.

Contaminant loss due to leaching is minimized by reducing the surface area available. Stabilization methods usually involve the addition of materials which limit the solubility or mobility of the waste constituents even though the physical handling characteristics of the waste may not be improved.

Stabilization and solidification techniques may include various fixating agents such as cement, silicate-based materials, and organic polymers; they may also utilize the adsorptive capabilities of various materials including thermoplastic processes, surface encapsulation, or vitrification.

Once the solidified material has been backfilled into the excavated area, capping would be used to cover the material to minimize contact with atmospheric waters. The use of capping at the Site as a supplemental or follow-up treatment subsequent to the backfilling of the stabilized sludge and soil would also help to deny human contact with the stabilized materials. The nature of the cap to be used with this alternative shall be determined from the results of the treatability study performed during the Remedial Design. Generally, capping is utilized when subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards and/or unrealistic costs, or the intent of the remediation is to isolate a non-mobile waste from direct contact.

The main disadvantages of capping include the potentially significant maintenance requirements as well as the uncertainty of the design life. For more information on the type of cap which would be used at the Site, refer to page 98.

Total Capital Costs:	\$1,090,000
Total O & M Costs:	\$121,000
Total Present Worth Costs:	\$1,211,000

Alternative 5: Excavation, Treatment with Vitrification, Backfilling, On-site Disposal, Capping

Alternative 5 includes excavating the contaminated sludge and soil, treating the materials with ex-situ Vitrification, backfilling and capping the area.

Vitrification uses electrical power to heat and melt contaminants in the sludge and soil to form a stable glass and crystalline structure with very

low leaching characteristics. Once the materials were vitrified, they would pass through a separation chamber, where the glass-like materials are separated from the gases. The gases then pass through a collection system before being discharged. The materials would be backfilled and capped in the same manner as in Alternative 4.

The advantages of vitrification include the potential ability to destroy, remove, or immobilize all contaminant groups and to reduce the waste/media being treated. The need for off-gas collection and treatment, however, is a disadvantage.

Total Capital Costs	\$1,058,000
Total O & M Costs	\$121,000
Total Present Worth Costs	\$1,179,000

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives to address groundwater and sludge/soil contamination were evaluated using the nine evaluation criteria as set forth in the NCP 40 CFR 300.430 (e)(9). A brief description of each of the nine evaluation alternatives is provided below.

THRESHOLD CRITERIA

1. Overall Protection of Human Health and the Environment addresses whether each alternative as a whole will provide adequate or institutional protection to human health and the environment. This includes an assessment of how the public health and the environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls placed on the property to restrict access and (future) development. A deed restriction is an example of control to restrict development.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) address whether or not a remedy complies with all State and Federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and cleanup options at a specific site. If an ARAR cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

PRIMARY BALANCING CRITERIA

3. Long-term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the cleanup levels have been met.

4. Reduction of Toxicity, Mobility, or Volume refers to the anticipated performance of the treatment technologies a remedy may employ. The 1986 amendments of the Superfund statute state that, whenever possible, EPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at the site; the spread of contaminants away from the source of contaminants; and the volume, or amount, of contamination at the site.

5. Short-term Effectiveness refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until cleanup goals are achieved.

6. Cost includes the capital (up-front) cost of implementing an alternative, as well as the cost of operating and maintaining the alternative over the long-term, and the net present worth of both the capital and operation and maintenance costs.

7. Implementability refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

MODIFYING CRITERIA

8. State Acceptance addresses whether the State concurs with, opposes, or has no comments on the alternatives EPA are proposing as the remedy for the site.

9. Community Acceptance addresses whether the public concurs with EPA's Proposed Plan. Community acceptance of this Proposed Plan will be evaluated based on comments received at the public meeting and during the public comment period.

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, which determine the overall feasibility and acceptability of the remedy. Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. Table 21 provides a summary of the ten alternatives retained after the evaluation process along with the total present worth costs for each. The evaluation of the potential remedial alternatives to address sludge, soil, and groundwater were developed as follows.

A. Groundwater Remediation

The following alternatives were subjected to detailed analysis for groundwater remediation:

Alternative 1: No Action

Alternative 2: Alternate Water Supply, Closure of Private Wells, Deed Restrictions, Monitoring

Alternative 3: Groundwater Treatment with Ultra-violet Radiation Oxidation, Precipitation/Filtration

Alternative 4: Groundwater Treatment with Alkaline Chlorination, Precipitation/Filtration, Air Stripping, Carbon Adsorption

Alternative 5: Groundwater Treatment with Alkaline Chlorination, Ion Exchange, Air Stripping, Carbon Alkaline

Overall Protection

Alternative 1 would not be protective of human health. Potential impacts to the environment were identified in the Risk Assessment, and if present would not be mitigated by this alternative. Alternative 2 would provide protection against any potential risk associated with the use of contaminated groundwater, but would require long-term enforcement of the institutional controls. Alternatives 3, 4, and 5 would mitigate current or future risks derived from exposure due to inhalation, dermal contact, and/or ingestion of contaminated groundwater.

Compliance with ARARs

Alternative 1 would not comply with the contaminant-specific ARAR regarding the cleanup of the groundwater contamination. ARAR waivers are not justified for this alternative because none of the criteria for a waiver are met through "No Action" remedial responses. Alternative 2 would not satisfy the North Carolina requirements regarding the restoration of Class GA waters (15A NCAC 2L) nor would it meet the chemical-specific ARAR for the aquifer (NC water quality standards). Alternatives 3, 4, and 5 would recover all contaminated groundwater and treat it to remediation levels.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminant concentrations contributing to the risks identified in the RI report. Groundwater contamination would continue to migrate offsite; therefore, it is not considered to be a permanent or effective remedial solution. Existing risks regarding the contaminated groundwater may decline in the future due to natural processes, but in the absence of engineering or institutional controls to prevent exposure, the Site will remain a threat to human health.

Contaminant concentrations would be permanently reduced through groundwater recovery and treatment in Alternatives 3, 4, and 5. Carbon adsorption (alternatives 4 and 5) is considered Best Available Treatment for volatile organic compounds in groundwater. Metals found in the groundwater would also be permanently reduced through either Precipitation/Filtration or Ion Exchange. EPA would conduct a five-year review of the remedial alternative to determine whether complete restoration of the aquifer is feasible.

Reduction of Toxicity, Mobility, or Volume

Alternatives 1 and 2 would have no impact on the toxicity, mobility, or volume of the contaminants in the groundwater other than those natural processes mentioned above. Continued extraction and treatment of the aquifer in Alternatives 3, 4, and 5 from the overburden/bedrock aquifer would effectively reduce the toxicity, mobility, and volume of the groundwater contamination plume.

Short-term Effectiveness

All of the alternatives can be implemented without significant risks to on-Site workers or the community and without adverse environmental impacts.

Implementability

No implementation is needed for Alternative 1. Alternative 2 would require extensive coordination between State and local agencies in order to institute long-term controls effectively.

Alternative 3 would require compliance with EPA, Department of Transportation (DOT), and any other regulations regarding the transport and disposal of hazardous materials. Alternatives 4 and 5 are technically feasible, but would require treatability studies to determine the effectiveness of each treatment technology.

Cost

Total present worth (PW) costs for the groundwater remediation alternatives are as follows:

Alternative 1: \$499,000

Alternative 2: \$922,000

Alternative 3: \$4,509,000

Alternative 4: \$5,181,000

Alternative 5: \$5,325,000

State Acceptance

The State of North Carolina conditionally concurs with the selected remedy. State comments can be found in Appendix A of this document, as well as EPA's responses to those comments.

Community Acceptance

A Proposed Plan fact sheet was released to the public on Thursday, April 9, 1992. The public meeting was held on April 16, 1992. The public comment period was held from April 9, 1992 to June 8, 1992. The letters and comments submitted during the April 16, public meeting, the 30-day comment period, and the 30-day extended comment period are summarized in the attached Responsiveness Summary.

B. Sludge/Soil Remediation

The following alternatives were developed for Site sludge and soils and were subjected to a detailed analysis:

Alternative 1: No Action

Alternative 2: Alternate water supply, Private well closure, Deed Restrictions, Monitoring

Alternative 3: Excavation, Off-Site Disposal at a RCRA Facility

Alternative 4: Excavation, Treatment with Oxidation-Reduction, Stabilization, On-site Disposal, Backfilling, Capping

Alternative 5: Excavation, Treatment with Vitrification, On-site Disposal, Backfilling, Capping

Overall Protection

Potential risks due to Site sludge and soils under both current and future conditions and potential future conditions (residential scenario) exceed the acceptable range of risk specified in the National Contingency Plan (NCP). Alternative 1 would not be protective of human health. Impacts on the environment have not been identified, but if present would not be mitigated by this alternative. Alternative 2 would reduce the potential risk due to dermal contact or ingestion of the sludge and soil, but would not be protective of groundwater or the environment. Alternatives 3, 4, and 5 would not only reduce the risk associated with dermal contact and ingestion, but would mitigate any further degradation of the groundwater by reducing the toxicity, mobility, or volume of the sludge and soil.

Compliance with ARARs

There are no Federal or State ARARs for inorganic contamination in soils. There are no action-specific ARARs for Alternatives 1 and 2. Alternative 3 would comply with EPA's off-site policy and applicable land disposal restrictions (LDRs). Alternative 4 and 5 would comply with all applicable ARARs, including LDRs (through a Treatability Variance under 40 CFR 268.44).

Long-term Effectiveness and Permanence

Alternatives 1 and 2 would not be effective in reducing contaminant levels and, therefore, would not be a permanent remedy. Alternatives 3, 4, and 5 would result in long-term reductions in contaminant levels.

Reduction of Toxicity, Mobility, and Volume

Inorganic contaminant levels would remain unchanged for Alternatives 1 and 2. Alternative 3 would reduce the toxicity, mobility, and volume of inorganics significantly. Alternatives 4 and 5 would reduce the mobility of the inorganics significantly, but would not reduce their volume or inherent toxicity.

Short-term Effectiveness

All of the alternatives can be implemented without significant risks to on-site workers or the community and without adverse environmental impacts.

Implementability

No implementation is needed for Alternative 1. Alternative 2 would require extensive coordination between State and local agencies in order to institute long-term controls effectively. Alternative 3 would require compliance with EPA, DOT, and NCDEHNR regulations regarding the transport

and disposal of hazardous materials. Alternative 4 is technically feasible, but would require treatability studies to determine the effectiveness of each treatment technology. Alternative 5, Vittrification, is not a proventechonology and its availability is limited.

Cost

The present worth (PW) costs for the sludge/soil remedial alternatives are as follows:

Alternative 1: \$499,000

Alternative 2: \$922,000

Alternative 3: \$2,363,000

Alternative 4: \$1,211,000

Alternative 5: \$1,179,000

State Acceptance

The NCDEHNR has reviewed and provided EPA with comments on the RI and FS Reports. The NCDEHNR also reviewed the Proposed Plan and EPA's preferred alternative and conditionally concurs with EPA's selection.

Community Acceptance

The community made verbal comments on the Proposed Plan during the public meeting held in April 1992. The community also made comments on the ROD during the comment period. Responses to each comment is included in Appendix B - the Responsiveness Summary, located at the end of this document.

X. THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected a remedy for contaminated sludge/soil and groundwater at this Site. This remedy will reduce the total cancer risk posed by the Site to a risk level that is within EPA's acceptable risk range of 10^{-4} to 10^{-6} , and which EPA considers to be protective of human health and the environment. To obtain this level, this remedial action alternative requires the extraction and treatment of groundwater above MCLs and State water quality standards, as wellas the excavation and treatment of sludge/soil which poses a potential health risk due to dermal contact and ingestion exposure. The total present worth cost of the selected remedy, Groundwater Alternative #4 and Sludge/Soil Alternative #4, is estimated at \$6,392,000. The major components of the remedy include:

A. Groundwater Remediation

Alternative 4: Groundwater Extraction, Treatment with Alkaline Chlorination, Precipitation/Filtration, Air Stripping, and Carbon Adsorption

B. Sludge/Soil Remediation

Alternative 4: Excavation, Oxidation-Reduction, Stabilization, Backfilling (On-site Disposal), and Capping

A. Groundwater Remediation

This remedial action will consist of a groundwater extraction and treatment system, and an overall monitoring program for the Site. Groundwater contaminated above the remediation levels indicated in Table 18 shall be extracted from the entire area known to be effected. The contaminated aquifer will be remediated until the remediation levels included in Table 18 are achieved.

For costing purposes during the Feasibility Study, six recovery or extraction wells were anticipated for the pump-and-treat system. The actual design, construction, and operation parameters of the extraction system shall be established during the remedial design phase, and shall be conducted in accordance with all ARARs listed in Section VII, including but not limited to the RCRA requirements set forth in 40 C.F.R. Part 264 (Subpart F). The actual monitoring requirements shall also be established during the Remedial Design phase. The extracted groundwater will first pass through an equalization tank for Ph and temperature adjustment and the flow will be equalized. Following equalization, alkaline chlorination will be used to destroy cyanide as well as VOCs in the groundwater with the use of chlorine compounds such as sodium hypochlorite, sodium hydroxide, or chlorine gas.

Chemical precipitation of dissolved metals from the groundwater is the next step in the treatment process. The metals will be precipitated from the solution as hydroxides, sulfides, or carbonates, depending on the precipitating agent(s). The sludge generated through the chemical precipitation process will subsequently undergo treatment and disposal in compliance with all ARARs listed in Section VII. The supernatant from the clarification tank will then pass through a multimedia filter to remove suspended solids.

Following precipitation/filtration, air stripping will be used to remove the VOCs from the groundwater by converting them from an aqueous state to a gaseous state (the VOC-laden air or gaseous stream generated during air stripping may require collection and subsequent treatment with vapor phase carbon adsorption). Carbon Adsorption will be used as the follow-up groundwater treatment to reduce VOC concentrations to cleanup levels. The treatment and/or disposal of spent filters used in either the air stripper or the carbon units will be in compliance with the ARARs listed in Section VII.

Discharge of the treated groundwater shall be either to the local, publicly owned treatment works (POTW), commonly referred to as the sewage treatment system, or as surface water discharge to an unnamed branch of Fishing Creek. Discharges from the groundwater treatment system shall comply with all ARARs listed in Section VII, including, but not limited to, substantive requirements of the NPDES permitting program under the Clean Water Act, 33

U.S.C. 1251 et seq., and all effluent limits established by EPA.

Groundwater shall be treated until the following levels are attained at the extraction wells:

Benzene	5 ppb
1,2,-Dichloroethane	0.38 ppb
1,1,-Dichloroethene	7 ppb
1,2,-Dichloroethene	70 ppb
Tetrachloroethene	0.7 ppb
1,1,1,-Trichloroethane	200 ppb
Trichloroethene	2.8 ppb
Vinyl Chloride	0.015 ppb
Barium	1,000 ppb
Chromium	50 ppb
Copper	1,000 ppb
Lead	20 ppb
Nickel	100 ppb
Zinc	500 ppb
Cyanide	154 ppb

The goal of this remedial action is to restore groundwater to its beneficial use as a drinking water source. Based on information collected during the RI and on a careful analysis of all remedial alternatives, EPA and the State of North Carolina believe that the selected groundwater remedy will achieve this goal. The ability to achieve remediation levels at all points throughout the area of the plume cannot be determined until the extraction system has been implemented, modified as necessary, and plume response monitored over time. If the implemented groundwater extraction system cannot meet the specified remediation levels, at any or all of the monitoring points during implementation, the system performance standards and/or the remedy may be re-evaluated. Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of containment technologies and institutional controls. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

For cost estimating purposes, groundwater extraction was projected for a period of 5 years, during which time the system's performance will be carefully monitored on a regular basis. Monitoring may be adjusted as warranted by the performance data collected during the initial operation of the system. Modifications shall be approved by EPA prior to implementation, and may include any or all of the following:

- . alternating pumping at wells to eliminate stagnation points;
- . pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater;
- . installation of additional extraction wells to facilitate or accelerate remediation of the contaminant plume; or
- . discontinue pumping at individual wells where remediation levels have been attained, only after analytical confirmation.

To ensure that remediation levels will be obtained and maintained, the aquifer will be monitored at those wells where pumping has ceased initially every year following discontinuation of groundwater extraction. This monitoring will be incorporated into an overall Site monitoring program, which will be fully delineated in the Operations and Maintenance portion of the Remedial Design. If EPA determines, on the basis of the preceding criteria and the system performance data, that certain portions of the aquifer cannot be restored to their beneficial use(s), EPA may require all of the following measures involving long-term management for an indefinite period of time, as a modification of the original system:

- . engineering controls such as physical barriers, or longterm gradient control provided by low level pumping, as containment measures;
- . chemical-specific ARARs may be waived for the remediation of those portions of the aquifer based on the technical impracticability of achieving further containment reduction;
- . institutional controls may be provided/maintained to restrict access to those portions of the aquifer which remain above remediation levels, since the aquifer is classified as a currentdrinking water source;
- . continued monitoring of specified wells; and
- . periodic re-evaluation of remedial technologies for groundwater restoration.

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at intervals of at least every five years, in accordance with CERCLA 121(c). To ensure State and public involvement in this decision at this Site, any changes from the remediation levels identified in this ROD will be formalized in either an Explanation of Significant Difference document or an Amendment to this Record of Decision. Depending on a number of variables such as allowable pumping rates and removal efficiencies, the period of extracting contaminated groundwater may last up to 30 years.

B. Sludge/Soil Remediation

Remediation of the metal-contaminated sludge/soil will include excavation and staging of the sludge/soil, treatment with oxidation-reduction and stabilization, followed by backfilling and capping of the area. Since it is not practical to separate the sludge and soil during excavation, the sludge/soil will be considered soil contaminated with RCRA listed hazardous waste.

A treatability study will be required during the remedial design to demonstrate that the Land Disposal Restrictions (LDRs) levels (standards) are achieved as the primary objective. In the event that the treatability study demonstrates, to EPA's satisfaction, that the LDRs levels cannot be achieved, then the treatability study shall demonstrate that the alternate Treatability Variance levels are achieved. Monitoring of the treated

sludge/soil will be required at the Site. If monitoring of the treated sludge/soil indicates that LDRs levels have been exceeded, or in the event that the treatability study demonstrates, to EPA's satisfaction, that the LDRs standards cannot be achieved and the alternate Treatability Variance levels have also been exceeded, the effectiveness of the remedy component will be re-evaluated.

The major components of sludge/soil remediation to be implemented include:

The sludge/soil will be excavated until the remaining soil achieves the health-based levels shown in Table 19. All excavation shall comply with the ARARs listed in Section VII. The excavated sludge/soil will be staged prior to treatment within the same Area of Concern from where it was excavated. In the event the excavated sludge/soil is staged outside the Area of Concern, the staging (including storage) must comply with the requirements of 40 C.F.R. 268.50.

Oxidation-reduction will be utilized as the initial treatment process to destroy the inorganics in the sludge/soil by converting them to nontoxic or less hazardous compounds. The oxidizing agents to be used will be approved by EPA during the remedial design. After first being slurried, the oxidizing agents and contaminants will be mixed in a process reactor where the oxidation or reduction reactions occur. Temperature and pH levels will be regulated to ensure the reaction goes to completion.

Stabilization will be the follow-up treatment subsequent to oxidation-reduction. The purpose of using stabilization is to reduce the mobility of the remaining metals in the sludge/soil. The metals are immobilized within a mixture containing a silicate- or cement-based fixating agent. The stabilized materials will be placed back into the areas previously excavated provided that LDRs levels (standards) or Treatability Variance levels have been achieved to EPA's satisfaction.

Backfilling and capping will follow-up the stabilization, and involves construction and operation of an engineering cover to deny human access to the solidified sludge/soil. Based on the results of the treatability study, a delisting of the waste may be sought by the party performing the work. In the event that the waste is delisted prior to capping, the cap to be constructed shall comply with the requirements established by RCRA, Subtitle D. In the event that the treatability study results show, to EPA's satisfaction, that the LDR and Treatability Variance levels are not being attained for delisting these wastes, they will be managed as RCRA Subtitle C hazardous waste. For such a RCRA listed hazardous waste, RCRA closure requirements require that a landfill closure be used at the Site. The unit must be capped with a final cover designed and constructed to:

- . provide long-term minimization of migration of liquids;
- . function with minimum maintenance;
- . accommodate settling and subsidence; and
- . have a permeability less than or equal to any bottom liner system or natural subsoils present.

Post-closure care includes maintenance of the final cover; operation of a leachate and removal system; and maintenance of a groundwater monitoring system [40 CFR 264.117, 264.228(b)].

Treatment Levels

The sludge/soil at the Site is considered to be a mixture of RCRA F006/F019 listed waste, soil, and any debris present in the Area of Concern. The treatment levels for the sludge/soil are therefore RCRA Land Disposal Restriction (LDR) standards.

The selected remedy shall achieve the LDRs levels set forth in 40 C.F.R. 268.41 and 268.43. Specifically, the selected remedy shall achieve the following LDRs levels in the TCLP extract:

Cadmium	.066 mg/l
Chromium	5.2 mg/l
Lead	.51 mg/l
Nickel	.32 mg/l
Silver	.072 mg/l

In addition, the selected remedy shall achieve the following LDRs levels in the non-TCLP extract:

Cyanide (total)	590 mg/l
Cyanide (amenable)	30 mg/l

In the event that the treatability study demonstrates, to EPA's satisfaction, that the selected remedy will not achieve the LDRs levels, then the selected remedy, as established below, shall comply with the LDRs through a Treatability Variance for the contaminated sludge/soil. The treatment levels or ranges established through the Treatability Variance that oxidation/reduction and stabilization will attain for each constituent, as determined by TCLP analyses, are:

Antimony	0.1-0.2 ppm
Arsenic	0.3-1 ppm
Barium	0.1-40 ppm
Chromium	0.5-6 ppm
Nickel	0.5-1 ppm
Selenium	0.005 ppm
Vanadium	0.2-20 ppm
Cadmium	0.2-2 ppm
Lead	0.1-3 ppm
Mercury	0.0002-0.008 ppm

In the event that the treatability study demonstrates, to EPA's satisfaction, that LDRs levels are not attained, or that the Treatability Variance levels are not attained, the remedy component for the treatment of the sludge/soil will be re-evaluated.

Treatability Study

A treatability study will be required during the remedial design phase to demonstrate that Alternative 4 will comply with the Land Disposal Restrictions (LDRs) levels (standards). In the event that the treatability study demonstrates, to EPA's satisfaction, that the LDRs levels(standards) cannot be achieved, then the treatability study shall demonstrate that the alternate Treatability Variance treatment levels are achieved. In the event that the treatability study demonstrates, to EPA's satisfaction, that the Treatability Variance levels cannot be achieved, then the remedy component will be re-evaluated. The treatability study will also determine the optimum stabilizing agent and stabilization mixture needed to meet the treatment levels. Based on the results of the treatability study, EPA may seek to delist the waste through an Explanation of Significant Difference (ESD) or ROD Amendment.

Additional Data Requirements/Monitor Existing Conditions

In addition to delineating the work specified above, the remedial design (RD) will also have to address a number of additional information/data requirements.

Since the RI was not able to completely define the extent of the groundwater contamination, especially in the bedrock zone of the aquifer, additional monitoring wells will need to be installed during the RD. The placement of these wells as well as the construction specifications will be made after a review and evaluation of the existing groundwater monitoring system. This review is to insure the groundwater monitoring system will provide adequate information to assess the long-term quality of the groundwater and to demonstrate the effectiveness of the groundwater extraction system. This review effort may also include additional groundwater modeling and aquifer testing.

In order to help establish a broader data base on groundwater quality, additional groundwater samples will be collected and analyzed for VOCs, SVOCs, and metals.

In addition to monitoring the groundwater, additional surface water and sediment samples shall be collected from the surface water pathways located adjacent to and downgradient of the Site to confirm and verify that these pathways are not being adversely impacted by the Site. If EPA determines that the Site is adversely impacting aquatic life in the surface water pathways, then toxicity testing using methods specified in U.S. EPA, Region IV, Standard Operating Procedure for Toxicity Testing Hazardous Waste Assessment, dated 1991, as amended, will be implemented. If contaminants in either surface water or sediment exceed screening criteria levels established by the National Oceanic and Atmospheric Administration (NOAA ER-L/ER-M), then a bio-survey will be conducted in conjunction with tissue analyses on appropriate organisms. Based on this data, it may be necessary to issue an Explanation of Significant Difference (ESD) or amend the ROD to incorporate the appropriate cleanup technology for either the surface water or the sediment or both.

XI. STATUTORY DETERMINATION

Under its legal authorities, EPA's primary responsibility at Superfund sites

is to undertake the remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements which must be attained by the selected remedy [NCP 40 CFR 300.430 (f) (ii) A-E]. These specify that when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment alternatives or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, and mobility of hazardous substances. The following sections discuss how the selected remedy meets the statutory requirements.

The selected remedy satisfies the requirements of Section 121 of CERCLA.

Overall Protection

The selected remedy will permanently treat the groundwater and sludge/soil, and will remove or minimize the potential risk associated with the ingestion of contaminated groundwater, as well as the potential risks due to dermal contact and incidental ingestion of contaminated sludge/soil.

Compliance With ARARs

The selected remedy will be designed to meet all Federal or more stringent State environmental laws. A listing of the ARARs which are to be attained is included in Section VII. This section also describes the TBC materials.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this action. Of the alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness, implementability, and cost; State and community acceptance, and the statutory preference for treatment as a principal element.

Preference for Treatment as a Principal Element

The preference for treatment is satisfied by the use of oxidation/reduction, stabilization, and capping to meet cleanup levels for the sludge/soil and the use of alkaline chlorination, precipitation/filtration, air stripping, and carbon adsorption to treat contaminated groundwater at the Site. The principal threats at the Site will be mitigated by use of these treatment technologies. Cost

The selected groundwater and sludge/soil remediation technologies are most cost-effective when compared with the other acceptable alternatives

considered. The selected remedies provide greater benefit for the cost because they permanently treat the waste.

XII. EXPLANATION OF SIGNIFICANT DIFFERENCE

The proposed plan issued by EPA in April 1992 selected Alternative 4 for both groundwater and sludge/soil remediation. In relation to the sludge/soil remediation, the proposed plan required excavation, oxidation/reduction, stabilization, backfilling (on-site disposal), and a non-RCRA cap.

The determination of whether to use a non-RCRA cap versus a RCRA cap will depend on the type of material that will be backfilled at the Site. The sludge/soil at the Site is considered to be a mixture of RCRA F006/F019 listed hazardous waste, soil, and any debris present in the area of concern.

Based on the results of the treatability study, a delisting of the waste may be sought. If the waste material is delisted, then a non-RCRA cap (RCRA subtitle D), will be used to cover the backfilled material. The proposed plan included this type of cap.

However, in the event that the waste material to be backfilled is not delisted before capping, the material will still be considered a RCRA F006/F019 listed hazardous waste. Therefore, the waste material will require handling and disposal as a RCRA hazardous waste (including a RCRA subtitle C cap). Based on the contingency of not being able to delist the waste, the selected remedy will require a RCRA subtitle C cap, as described in section X of the Record of Decision. This eventuality differs from the non-RCRA cap included in the proposed plan. This change is required in order to comply with the applicable RCRA requirements.

APPENDIX A

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

30 June 1992

Mr. McKenzie Mallary
Remedial Project Manager
US EPA Region IV
345 Courtland Street, NE
Atlanta, GA 30365

RE: Draft Record of Decision
JFD Electronics/Channel Master

NCD 122 263 825
Oxford, Granville County, NC

Dear Mr. Mallary:

The North Carolina Superfund Section has received and reviewed the Draft Record of Decision for the subject site. A copy of this document has also been forwarded to the North Carolina Division of Environmental Management (DEM) for concurrent review. Comments from DEM will be forwarded when they are received by our office. The North Carolina Superfund Section concurs with the chosen remediation technologies conditioned on the following requirements being met:

1. Treatability studies as discussed on page 100 of the ROD will be used during the Remedial Design phase to ensure that the chosen soil remediation technologies will achieve the cleanup goals.
2. Onsite disposal of treated soil must meet the requirements of the North Carolina Solid Waste Disposal Regulations (NCAC Title 15A, Chapter 13B, Section .0503). Specifically the treated soil may not be deposited less than four feet above the seasonal high groundwater table. It is our understanding that the treated soil/sludge will contain extractable levels of contaminants less than ten times the NC Groundwater standards as specified in NCAC Title 15, Subchapter 2L, Section .0202.
3. The on-site disposal of treated soil/sludge or presence of any residual contamination that presents an overall total risk greater than 10⁻⁶ will require deed recordation/restriction to document the presence of residual contamination and limit future use of property as specified in G.S. 130A-310.8.
4. The minimum buffer requirements as set forth in North Carolina Location Requirements for Hazardous Waste Facilities (NCAC Title 15A, Chapter 13A, Section .0009 [c and r]) must be met for any proposed on-site treatment technology. Data must be presented to address the applicable risk posed standards for the North Carolina Location Criteria in NCAC Title 15A, Chapter 13A, Section .0009 (c and r).
5. The proposed soil cleanup level of 310 ppm as specified in Table 19 of the ROD should assume all of the chromium is trivalent not hexavalent as indicated in Table 19.

The North Carolina Superfund Section appreciated the opportunity to review this document. If you have any questions please contact me at (919) 733-2801.

Sincerely,

Jack Butler, PE
Environmental Engineering Supervisor
Superfund Section

JB/dk/19

cc: Curt Fehn

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET NE
ATLANTA, GEORGIA 30365

JUL 09 1982

4WD-NSRB

Mr. Jack Butler
North Carolina Dept. of Environment, Health, and Natural Resources
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27605

Subject: Responses to ROD Comments JFD Electronics/Channel Master Site

Dear Mr. Butler:

EPA-Region IV appreciates the State's conditional concurrence with the Record of Decision (ROD) for the JFD Electronics/Channel Master site located in Oxford, North Carolina. For the record, EPA would like to respond to the comments made by NCDEHNR-Superfund Section, as submitted in your letter to me dated June 30, 1992. The purpose of these responses is merely to reflect our telephone conversation made on July 9, 1992 with Curt Fehn. This letter, along with your June 30, 1992 letter, will be included as an appendix to the ROD. These letters should stand as official documentation that EPA-Region IV and NCDEHNR-Superfund Section have agreed on the preferred alternatives at this point in time, based on the following conditions:

- 1) that Treatability Studies will be conducted on the chosen remedies to ensure that the cleanup levels can be met;
- 2) that clean fill will be placed into the excavated sludge pits to ensure that the treated sludge/soil will not be deposited less than four feet above the seasonally high water table, and that by doing so, the original grade of the area will be affected (without any lateral expansion). We also agreed that a cap would be necessary on top of the affected area;
- 3) the treated sludge/soil will pass TCLP. As stated in the past, EPA's position is that the State's policy of comparing extractable levels of contaminants to either its groundwater standards or ten times its groundwater standards is not enforceable and thus not an ARAR. However, we anticipate that, at this Site, the treated sludge/soil will probably contain extractable levels of contaminants less than ten times the NC Groundwater Standards as specified in NCAC Title 15, Subchapter 2L, Section .0202;
- 4) that, in the future, the State may put in place, pursuant to State law (G.S. 130A-310.8), a deed recordation to document the presence of an "inactive hazardous substance or waste disposal site";

5) that the location requirements (NCAC Title 15A, Chapter 13A, Section .0009 (c and r)) for the Site regarding the location of any treatment units with regard to a 100-year floodplain will be met. We also agreed that the sludge bed area (or future treatment/disposal area), to the best of our knowledge, does not violate location requirements with regard to its proximity to residential dwellings, wells, or any other requirement; and

6) that the sludge/soil cleanup level for chromium (310 ppm for a child) is calculated for hexavalent chromium, whereas the calculated cleanup level for trivalent chromium is 59,500 ppm for a child.

Please contact me at (404) 347-7791 if you have any questions or comments regarding this matter.

Sincerely,

McKenzie Mallary
Remedial Project Manager

cc: Curt Fehn